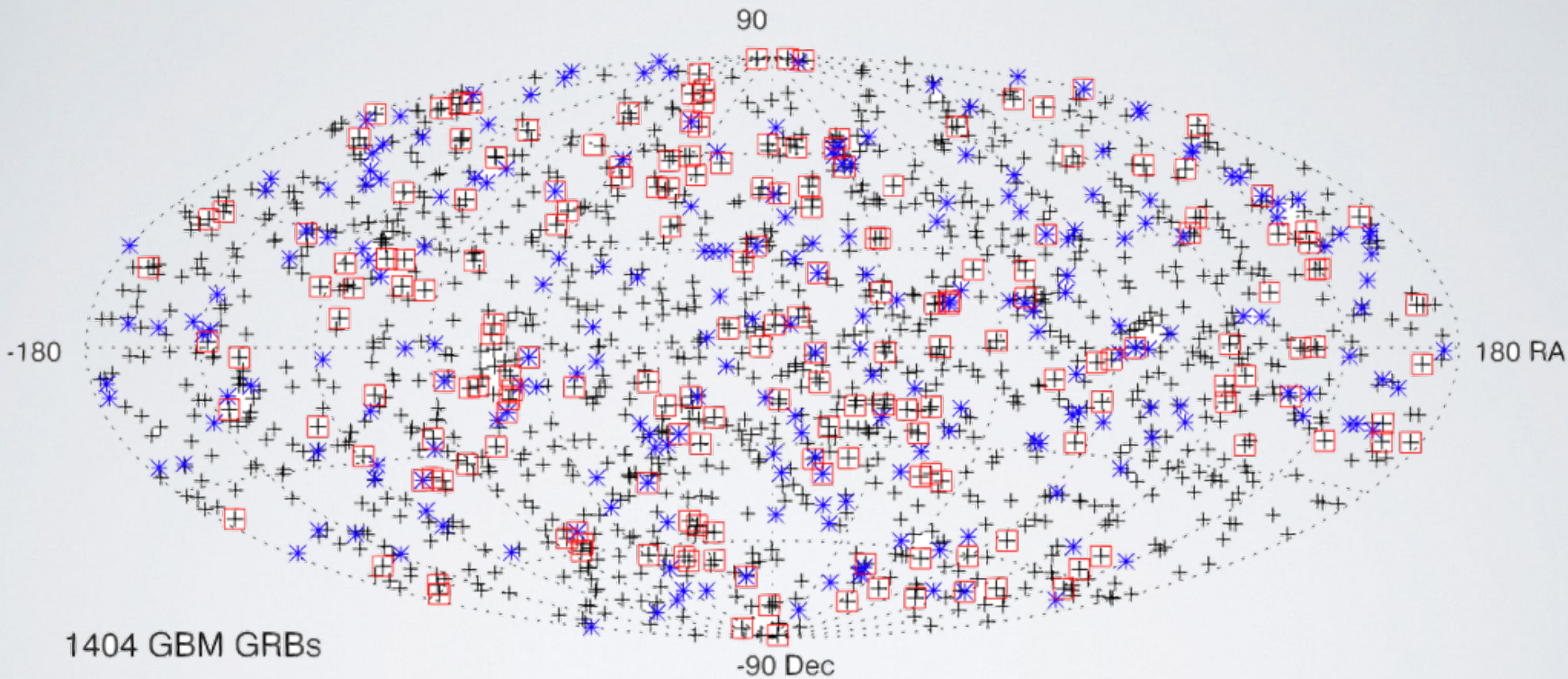


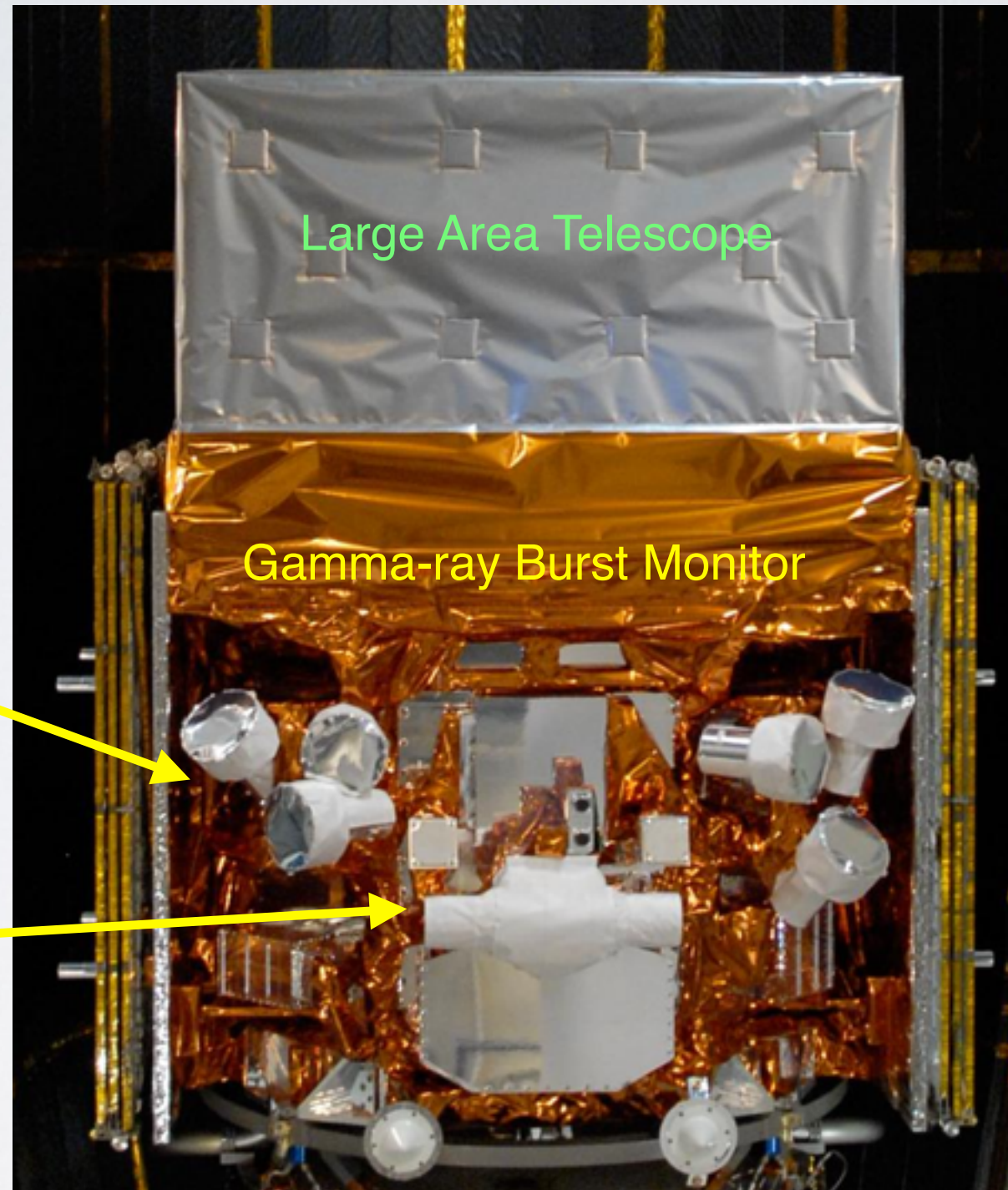
Transients with Fermi GBM

short GRB untriggered search



C. Michelle Hui (NASA/MSFC)

Fermi Gamma-ray Space Telescope



12 NaI detectors
(8keV—1MeV)

2 BGO detectors
(200keV—40MeV)

GBM:

- FOV $>7\text{sr}$
- Whole sky every 3 hours

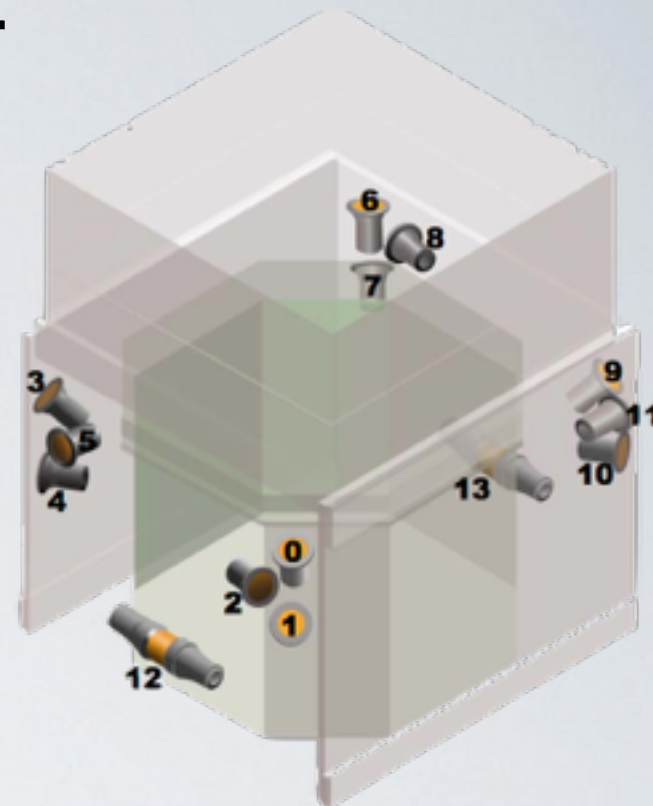
Fermi Gamma-ray Burst Monitor

Regular trigger algorithms:

- Count rate increase in 2+ NaI detectors above adjustable threshold above background rate
- 10 timescales — 16ms up to 8.192s
- 4 energy ranges — [50-300], [25-50], >100, >300 keV

Untriggered search algorithms:

- Initially developed for Terrestrial Gamma-ray Flash search
 - more details at <http://fermi.gsfc.nasa.gov/ssc/data/access/gbm/tgf>
- Using Continuous Time Tagged Events (CTTE) — $2\mu\text{s}$ time resolution with 128 energy channels
- 2 detectors: 2.5σ and another 1.25σ above background
 - one-day probability threshold for release
- 10 timescales — 0.1s to 2.8s
- 5 energy ranges (optimized on GBM-triggered weak sGRBs)
- Unfavorable geometry of the two above-threshold detectors are eliminated
- Soft and long duration candidates are removed



Fermi GBM Counterparts to LIGO GW Candidates — J. Racusin, session R14 Mon Apr 18
Fermi GBM Follow-up of the First GW Detection — L. Blackburn, session X4 Tues Apr 19

Untriggered GBM Short GRB Candidates

http://gammarray.nsstc.nasa.gov/gbm/science/sgrb_search.html

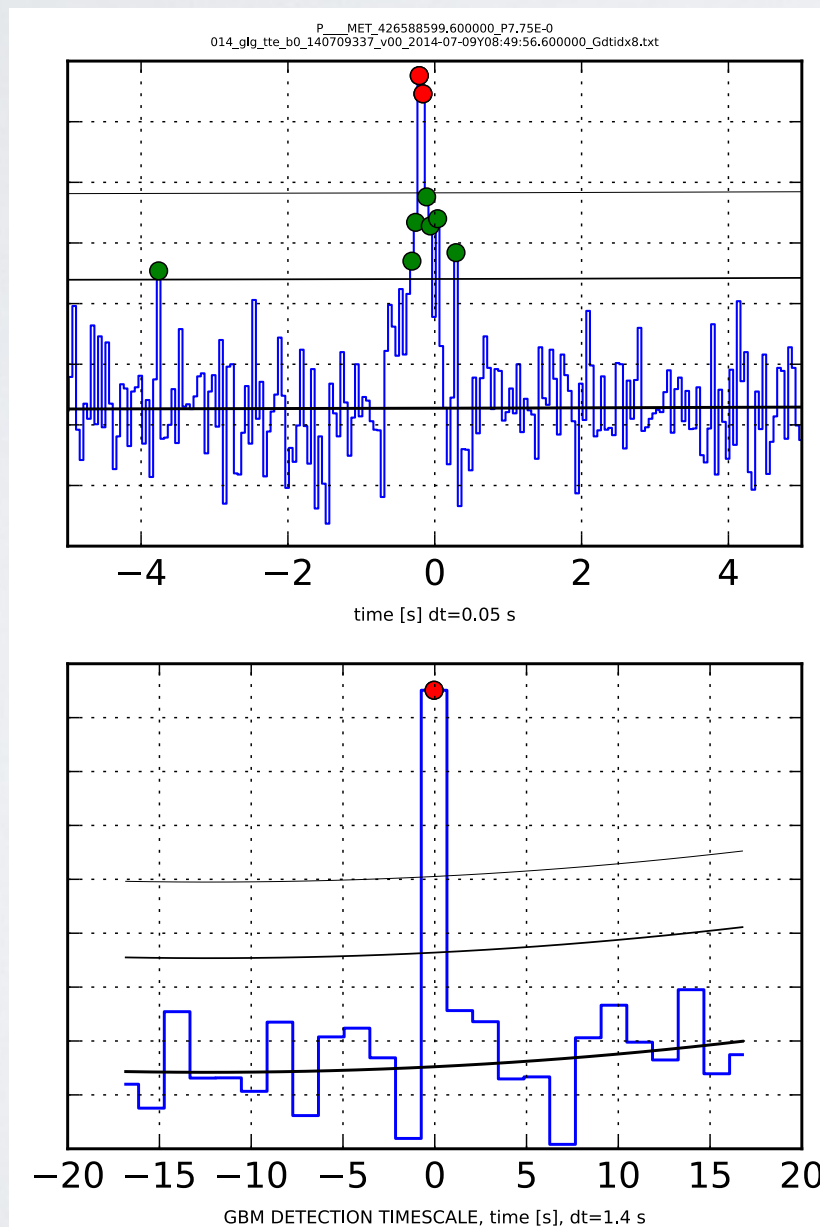
- A list of the untriggered candidates (June 2014 to present) are listed in website above.
- Working towards creating automated GCNs, will be distinct from triggered events type.

Short GRB Candidates							
MET	RANK	DATE (UT)	TIME (UT)	RA (DEG)	DEC (DEG)	ERROR (DEG)	COMMENT
423745096.625	1.91E-0016	2014-06-06	10:58:13.625	232.07	+37.47	18.86	
424708158.025	2.36E-0007	2014-06-17	14:29:15.025	359.06	-32.47	5.59	
424757010.500	1.92E-0016	2014-06-18	04:03:27.500	278.84	+64.38	4.67	
424968038.500	2.80E-0007	2014-06-20	14:40:35.500	319.45	-17.40	17.05	
426319641.550	2.00E-0010	2014-07-06	06:07:18.550	64.10	+25.04	6.41	
426588599.600	7.75E-0014	2014-07-09	08:49:56.600	12.77	-49.36	6.53	
426950830.700	4.21E-0007	2014-07-13	13:27:7.700	264.57	-87.36	13.49	
427440502.000	2.65E-0007	2014-07-19	05:28:19.000	34.37	+45.94	15.21	
431283951.000	3.82E-0008	2014-09-01	17:05:48.000	80.94	+69.19	16.02	
431291510.000	3.03E-0007	2014-09-01	19:11:47.000	81.08	-17.32	15.88	
432797599.000	3.30E-0007	2014-09-19	05:33:16.000	177.15	-37.38	20.86	
433789586.000	1.95E-0007	2014-09-30	17:06:23.000	283.03	-9.27	11.33	
436073076.650	2.18E-0007	2014-10-27	03:24:33.650	62.59	-52.26	11.90	
437185383.600	3.72E-0014	2014-11-09	00:23:0.600	289.76	-28.56	14.73	
437703742.200	1.71E-0007	2014-11-15	00:22:19.200	107.66	-19.52	13.08	

GBM Candidate Event

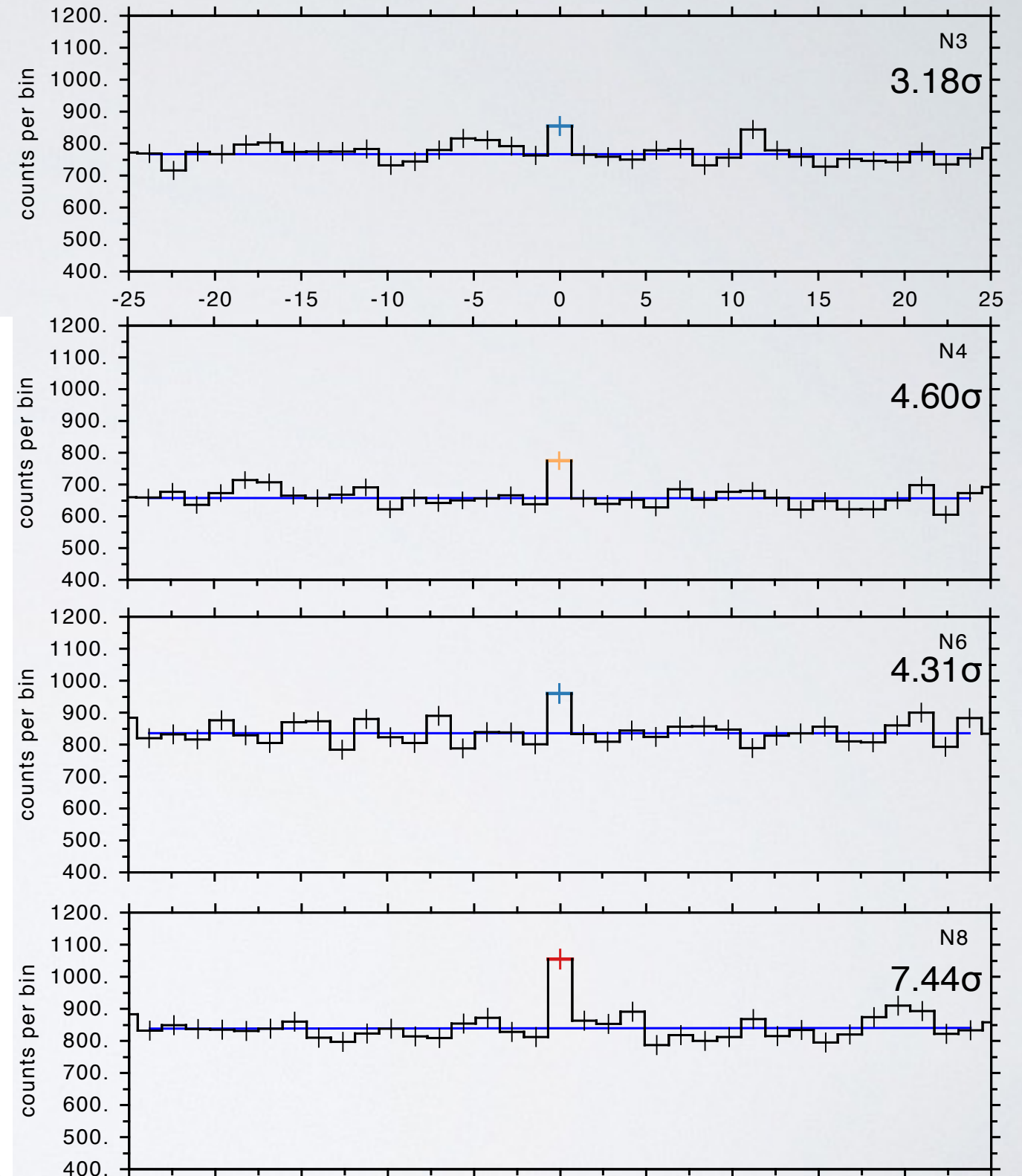
- 2014-07-09 08:49:56.600
- Found in 1.40s time binning
- 25 - 494 keV energy range
- $P=7.75e-14$

ACS lightcurve



ACS native
time bin

GBM timescale

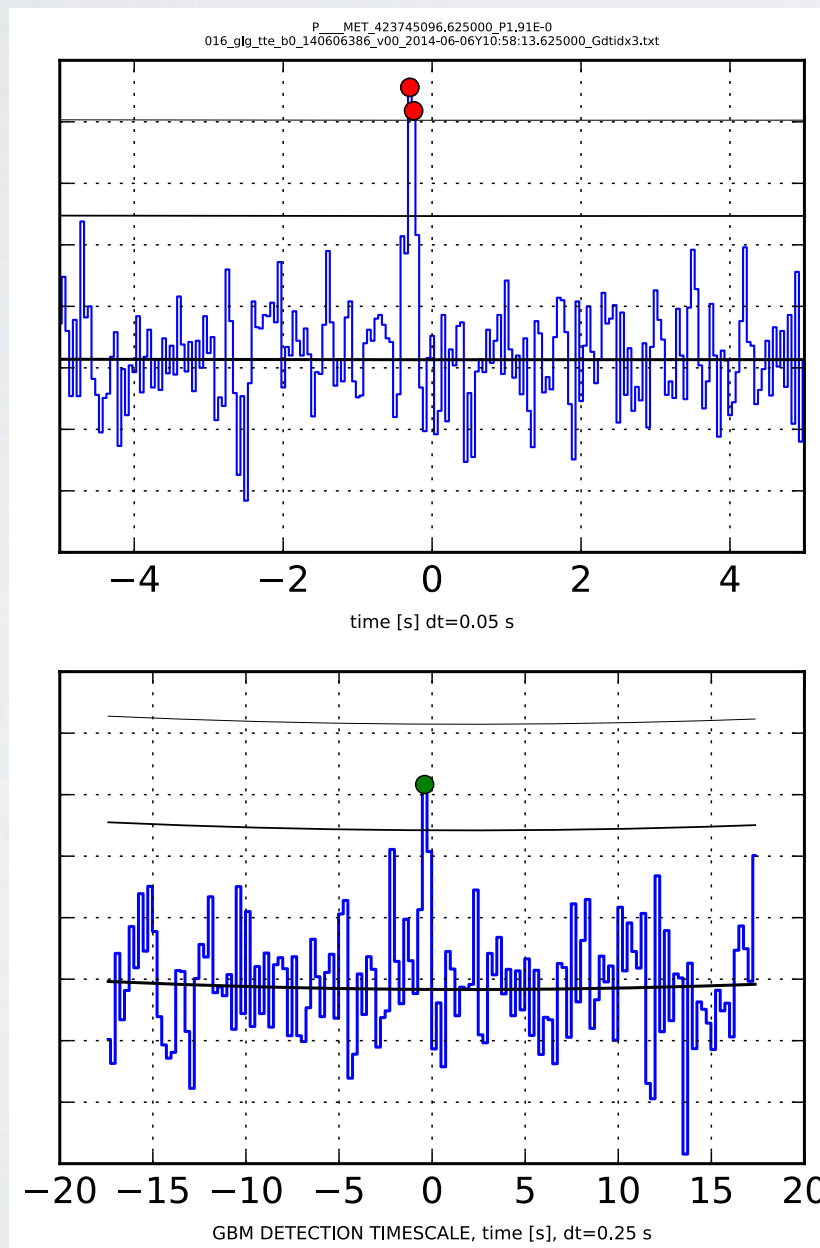


GBM Candidate Event

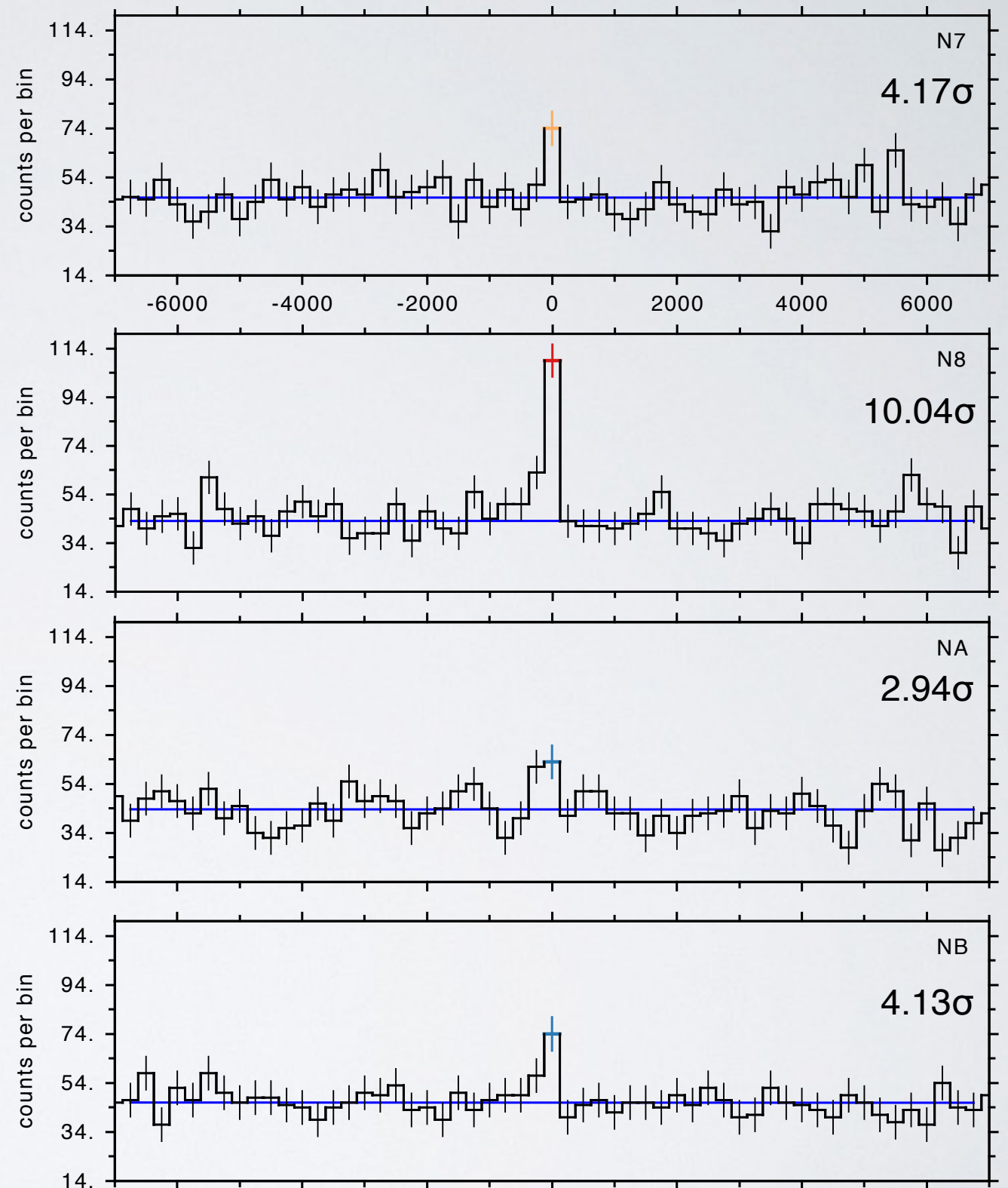
- 2014-06-06 10:58:13.625
- **Swift GRB 140606A**
- Found in 0.25s time binning
- 93 - 494 keV energy range
- $P=1.91\text{e-}16$

ACS lightcurve

ACS native
time bin



GBM timescale



Outlook

- Optimization on search algorithm and thresholds are ongoing
- Pending exclusion of known gamma-ray repeaters and transients based on localization and spectrum
- Working towards correlation with Swift and INTEGRAL data
 - GRB 140606A detected by Swift is not triggered in GBM but identified by this untriggered search
- Eventual GCN notices of a distinct type

http://gammaray.nsstc.nasa.gov/gbm/science/sgrb_search.html